

AD-A264 522



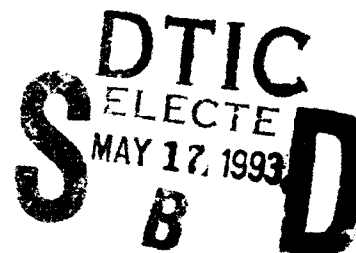
AD

AD-E402 414

Technical Report ARAED-TR-93004

**XM898 PROJECTILE 155-mm SADARM PACKAGING
DESIGN AND ENGINEERING TEST REPORT**

Mark P. Nitzsche



April 1993



US ARMY
ARMAMENT MUNITIONS
& CHEMICAL COMMAND
ARMAMENT RDE CENTER

**U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND
ENGINEERING CENTER**

Armament Engineering Directorate

Picatinny Arsenal, New Jersey

Approved for public release; distribution is unlimited.

93 5 14 03 7

93-10841



The views, opinions, and/or findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

The citation in this report of the names of commercial firms or commercially available products or services does not constitute official endorsement by or approval of the U.S. Government.

Destroy this report when no longer needed by any method that will prevent disclosure of its contents or reconstruction of the document. Do not return to the originator.

REPORT DOCUMENTATION PAGE			Form Approved OMB No: 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operation and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE April 1993		3. REPORT TYPE AND DATES COVERED
4. TITLE AND SUBTITLE XM898 PROJECTILE 155-mm SADARM PACKAGING DESIGN AND ENGINEERING TEST REPORT			5. FUNDING NUMBERS	
6. AUTHOR(S) Mark P. Nitzche				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESSES(S) ARDEC, AED Packaging Division (SMCAR-AEP) Picatinny Arsenal, NJ 07806-5000			8. PERFORMING ORGANIZATION REPORT NUMBER Technical Report ARAED-TR-93004	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(S) ARDEC, IMD STINFO Br (SMCAR-IMI-I) Picatinny Arsenal, NJ 07806-5000			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This report details the testing and results of rough handling/transportation tests performed on the palletized XM898 155-mm Sense and Destroy Armor projectile. Two palletization configurations were tested: the standard wood pallet and the metal field artillery projectile pallet. The testing was performed at three temperatures: -65°F, ambient, and +160°F.				
14. SUBJECT TERMS XM898 projectile SADARM FAPP Rough handling Secured vibration Vibration schedule			15. NUMBER OF PAGES 34	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT SAR	

CONTENTS

	Page
Introduction	1
Objective	1
Discussion	1
Test Configurations	1
Test Procedure	2
Results	2
Conclusions	8
Metal Pallet	8
Wood Pallet	9
Modified Grommet	9
Distribution List	33

FIGURES

1	Metal pallet after testing (ambient)	11
2	Metal pallet base after testing (160°F)	12
3	Metal pallet base after testing (-65°F)	13
4	Metal pallet cover after testing (-65°F)	14
5	Metal pallet after testing (-65°F)	14
6	Wood pallet after testing	15
7	Wood pallet base after testing	16
8	Pallet for 155 mm projectile, hollow base	17
9	Field artillery projectile pallet (FAPP) assembly	18
10	Packing and marking 155 mm projectile pallet	19

FIGURES (cont)

	Pages
11 Liner, cover	20
12 Grommet for M898 and M864 (155 mm) projectile	21
13 Modified grommet	22
14 Wood pallet cover piece, improper manufacture	22
15 Wood pallet	23
16 Wood pallet base modified with disks	23
17 Wood pallet cover secured vibration test (+160°F)	24
18 Wood pallet secured vibration test (+160°F)	25
19 Metal pallet after loose cargo test	26
20 Broken obturator band after pallet testing (-65°F)	27
21 Metal pallet after loose cargo test (-65°F)	28
22 Wood pallet cover after 1st cornerwise drop (-65°F)	30
23 Wood pallet after 2nd cornerwise drop (-65°F)	31
24 Wood pallet cover after rollover (ambient)	32
25 Metal pallet cover after sudden lift test	32

Accession For		<input checked="" type="checkbox"/>
NTIS GRA&I		<input type="checkbox"/>
DLC TAB		<input type="checkbox"/>
Unannounced		
Justification		
By		
Distribution/		
Availability Codes		
Avail and/or		
Special		
Dist		
A-1		

INTRODUCTION

In developing packaging for the new XM898 Sense and Destroy Armor (SADARM) projectile, the Packaging Division, U.S. Army Research, Development and Engineering Center (ARDEC), conducted a series of transportation/rough handling tests on two different pallet configurations. The SADARM projectile is a thin-walled 155-mm projectile which dispenses two submunitions. The two pallet configurations tested were the (metal) field artillery projectile pallet (FAPP), P/N 12926862 and the standard wood pallet, P/N 8837839. Both configurations had been previously tested and certified for use with other projectiles. This report details the results of these tests.

OBJECTIVE

The testing was performed to ensure fit and function of the metal pallet with the XM898 projectile. Due to the limitations of the test projectiles used, evaluation of the effect of the testing is limited to fit of the projectile in the pallet and external physical damage on the projectiles. The objective of the testing was to determine if the SADARM projectile in its palletized configuration is afforded adequate protection against external damage during its handling, transportation, and storage environments. Photographs depicting the results of the metal and wood pallet testing are in figures 1 through 7.

DISCUSSION

Test Configurations (figs. 8 through 12)

The FAPP configuration uses two center rods which fasten the cover to the base, using latches located in the cover. Projectiles are placed in plastic spacers which are fastened to the pallet base. Both the base and cover are constructed of metal. The wood pallet consists of a wood base and cover fastened together using metal strapping. The initial FAPP design employed 14-gauge steel. However, during testing in the original development and qualification phases, the design was changed to 12 gauge. Since pallets constructed of 12-gauge steel were not available at the time of testing, pallets constructed of 14 gauge were modified with additional material to bring them up to 12 gauge. The pallets were modified the same way as those used in the original FAPP pallet qualification testing.

The test projectiles employed were inert XM898 projectiles, each containing two mass models. The grommet employed was P/N 9321436, the same as that used on the M864 projectile. Due to the fact that the rotating band is closer to the end of the XM898 projectile than other projectiles which use this grommet, an interference resulted. The grommet contacted the base of both the wood and metal pallets before

the projectile was completely seated in the pallet. This interference necessitated a modification to the grommet. The lower tab on the grommet was removed, and the lower loop of the grommet fastener was reformed to reduce its diameter (fig. 13). In testing the wood pallet, the interference problem became more severe. The modified grommet was not sufficient, and further modification to the pallet was required. Wood plugs were designed and inserted in the openings in the base of the pallet to eliminate further interference problems. Use of these plugs created a clearance which was great enough to allow use of a standard unmodified grommet.

Test Procedure

The transportation/rough handling tests using the FAPP were conducted in accordance with the test procedures outlined in the, "Test Plan for Handling, Transportation, and Storage Testing of Palletized XM898 Sense and Destroy Armor (SADARM) 155-mm Projectile." With the exception of the forklift impact test and the weights used for the stacking and hoisting tests, the test sequence was repeated using the wood pallet. Because of the limited number of wood pallets available at the time of testing and the damage sustained by the wood pallet, the +160°F test sequence was limited to secure vibration only.

Results

Stacking Test

Loads of 3720 lb for the metal pallet and 3400 lb for the wood pallet were applied to the top of the palletized load for 24 hr. The loads were applied in a manner which simulated the effect of similar pallets being stacked to a height of 16 ft on the test pallet. The loads had no effect on either the metal or wood pallet or the projectiles.

Vibration (Secured)

The test plan called for the pallet to be securely fastened to a vibration table and vibrated in all three axes in accordance with the wheeled, two wheel trailer, and tracked vehicle schedules listed in MIL-STD-1904. However, due to the limitations of the electro-dynamic vibration table, which was the only table available at the time the metal pallet was tested, the schedule had to be modified. At the beginning of the testing of the wood pallet, a hydraulic vibration table was available. This table was capable of producing the full vibration schedule called for in the test plan. However, when the wood pallet was vibrated to the full schedule it was severely damaged. Subsequently, it was determined that the damage was attributed to an improperly constructed pallet cover (fig. 14). However, it was decided to retain the modified vibration schedule for comparison purposes. Therefore, the wood pallet was vibrated to the modified schedule used for the metal pallet.

Damage sustained by the metal pallet during secured vibration at ambient was limited to the spacers (P/N 12914692) and the liner covers (P/N 12926863). Some of the tabs on the spacers snapped and became loose. All of the liner covers exhibited some degree of tearing and compression, and the lifting plugs on the projectiles did not maintain the specified torque. Before the secured vibration at +160°F, four of the eight spacers in the pallet were cut at one section. This modification was used during the original pallet qualification testing. For comparison purposes, the four cut spacers were staggered in their placement in the pallet base. After testing it was noted that only the tabs on the spacers which were not cut sustained damage. Again, all the liner covers exhibited some degree of tearing and compression, and the lifting plugs loosened.

Prior to secured vibration testing at -65°F, the method of cutting and staggering the spacers was repeated. The damage sustained was similar to that sustained during secured vibration at +160°F.

The cumulative effect of the secured vibration testing on the metal pallet was that a small (< 1/4 in.) amount of clearance was created between the portion of the projectile lifting plug upon which the cover of the pallet rests and the cover assembly (P/N 12914624). This occurred at each of the three temperatures, but there was no evidence of damage to the projectiles and the function of the metal pallet was not affected in any way.

As previously stated, the wood pallet sustained severe damage during secured vibration in the vertical axis at ambient. This testing was done in accordance with the schedule originally required by the test plan. No problems were encountered during vibration in the longitudinal and transverse directions. However, while testing in the vertical axis several of the projectiles broke through the pallet cover. In addition, the pallet base was severely splintered.

The test was then repeated at ambient with a new pallet using the same vibration schedule as that employed for the metal pallet. During this secured vibration test sequence, grooves up to 1/2 in. deep were formed in each of the cutouts in the pallet base. These grooves were formed by the bottom rim of the projectile base assembly, which is thinner than those currently used. The rim cut into the wood of the pallet base as the projectiles rotated. These grooves resulted in the projectiles sitting lower in the pallet base, and contact being made between the modified grommets and the pallet base. In one case, a grommet was forced up, severing an obturator band. No other damage to the projectiles was noted. To eliminate this interference problem, modification to the wood pallet was required. Wood plugs consisting of two different diameter disks of 3/4 in. plywood were constructed (glued and nailed together). The larger disk fits in the cutout in the pallet base and the smaller disk fits inside the bottom

rim of the projectile base assembly. The projectiles, therefore, rest on a solid plywood surface which helps prevent a groove from being formed. In addition, the height provided by the larger disk eliminates the need to use a modified grommet (figs. 16 and 16).

A new wood pallet was modified using the wood plugs and then subjected to secured vibration testing at +160°F. No damage was noted after testing in the horizontal and transverse directions. However, during testing in the vertical axis one of the projectiles broke through the holes in the pallet cover. As a result the projectile came out of the pallet base (figs. 17 and 18). In addition to the enlarged hole in the pallet cover, splintering and splitting of the wood around the other holes in the pallet cover and the pallet base occurred. Two grommet wires were bent, with one of the grommets coming open. There was no evidence of damage to the projectiles. However, the extent of damage sustained by the pallet prevented the +160°F test sequence from continuing. Upon further inspection it was noted that the wood covers of the test pallets were improperly constructed. On the underside of the plywood there were counterbores up to approximately 1/8 in. deep. These counterbores are not in accordance with the wood pallet drawing. The resulting weakening of the plywood appears to have been the cause of the pallet failure during the initial secured vibration testing at ambient and the secured vibration testing at +160°F. Due to a shortage of available pallets and the questionable manufacture of those available, the +160°F test sequence was not concluded.

Prior to the cold (-65°F) testing sequence the cover for the new wood pallet was modified. The plywood top, as previously stated, was not manufactured properly in accordance with drawing 8837839 and was removed. It was replaced with a properly machined plywood top. Newly constructed wood plugs were used in the pallet base.

During secured vibration testing at -65°F, the bottom rims of the projectiles again cut into the base of the wood pallet. However, the depths of the grooves were only about 1/8 in., and there remained substantial clearance (approximately 1/2 in.) between the grommets and the pallet base. The other damage sustained by the wood pallet was in the cover. One lifting plug hole was elongated and another splintered in the area of the chamfer. At the completion of secured vibration at -65°F, there was no evidence of damage to the projectiles, and they remained consolidated in the wood pallet.

Loose Cargo

As described in MIL-STD-1904, each pallet was placed on a loose cargo machine and vibrated at a frequency of 5 Hz with the vibratory surface having a displacement of 1 in. double amplitude. However, because of problems encountered with the table in attempting to employ vertical circular synchronous motion, vertical linear motion used. The speed was such that it provided a minimum of 3/16 in. clearance between the bottom of the pallet and the table surface at 276 rpm.

The damage sustained by the metal pallet during loose cargo testing at ambient and at +160°F was similar to that produced by the secured vibration testing. Again, there was no evidence of damage to the projectiles and the function of the metal pallet was not affected in any way (fig. 19).

The metal pallet experienced considerable damage during loose cargo testing at -65°F. All of the cover liners were severely damaged, and the spacers shattered. In addition, the destruction of the spacers caused the projectiles to drop and there was contact between the pallet base and the four outer grommets. All four of these grommets displayed wear from the contact with the pallet. In one instance, the contact forced the grommet up slightly, severing the obturator band (fig. 20). Despite the damage to the pallet, however, the projectiles remained consolidated within the pallet and testing was able to continue (fig. 21).

The wood pallet was subjected to the loose cargo test at ambient and -65°F. The pallets sustained no additional damage as a result of loose cargo testing, and there was no evidence of damage to the projectiles.

Edgewise Drop

One end of the pallet was placed on a block 5 in. high and the opposite end was raised to a height of 12 in.; then dropped. This was performed twice, once on each end of the pallet.

At all three temperatures the metal pallet sustained minor abrasion of metal and paint as a result of the edgewise drops. There was no effect on the function of the pallet. There was no evidence of damage to the projectiles.

At ambient, the wood pallet sustained only minor splintering as a result of the edgewise drops. At -65°F the cover sustained slight separation of the plywood layers in the area where the edge of the cover struck the ground. There was no evidence of damage to the projectiles as a result of the edgewise drop test.

Cornerwise Drop

One corner of the pallet was placed on a block 5 in. high. The other corner of the same end of the pallet was placed on a block 12 in. high. The opposite end of the pallet was raised to a height of 12 in.; then dropped. This was performed twice, on diagonally opposite corners of the pallet.

At all three temperatures, the metal pallet sustained minor abrasion of metal and paint as a result of the edgewise drops. There was no effect on the function of the pallet. There was no evidence of damage to the projectile.

At ambient, the wood pallet sustained only minor splintering as a result of the cornerwise drops. During the first cornerwise drop at -65°F, the plywood separation which occurred during the edgewise drop became more severe. While the pallet was being hoisted upright in preparation for the second cornerwise drop at -65°F, one of the lifting plugs, which still secure to the projectile, broke through the pallet cover. The hole which the lifting plug broke through was the one which was elongated during secured vibration near one of the areas which had sustained separation of the plywood layers. As a result of this damage, testing could not continue (fig. 22). Therefore, the pallet cover was removed and replaced with the cover which had gone through the entire test sequence at ambient. During the second cornerwise drop, however, the projectile at the corner on which the pallet was being dropped again broke through the cover. In this instance, the base of the projectile dislodged from the base of the pallet (fig. 23). The cause of failure again appeared to be separation of the layers of wood in the plywood cover piece. Despite the cover failures, the only damage sustained by the item (grommet) was that the plastic tabs which hold the wire were broken off when the projectile came out of the pallet. However, the grommet remained in place. Aside from moderate splintering of the pallet base and the wood plug for the projectile which became dislodged, there was no evidence of damage to the projectiles. Following the second cornerwise drop, the cover of the pallet was again replaced so that testing could continue.

Rollover

The pallet was tipped so that it fell onto its side. The base was then lifted so that the pallet was inverted. The pallet was then tipped so that it fell onto its other side.

At all three temperatures, the metal pallet sustained minor abrasion of metal and paint as a result of the rollover test. There was no effect on the function of the pallet. There was no evidence of damage to the projectiles.

The wood pallet sustained only minor splintering of the base and cover as a result of the rollover test. There was no evidence of damage to the projectiles (fig. 24).

Pendulum Impact

The pallet was suspended by chains as it rested against a solid wood barrier. The pallet was then pulled back until the center of gravity of the pallet was raised 20.5 in., then released, allowing the pallet to impact against the barrier.

At all three temperatures, the metal pallet sustained minor abrasion of metal and paint as a result of the pendulum impact test. There was no effect on the function of the pallet. There was no evidence of damage to the projectiles.

The wood pallet sustained only minor splintering of the base and cover as a result of the pendulum impact test which was performed at ambient and -65° F.

Hoisting Test

The loaded pallet was additionally loaded to three times its gross weight and then lifted off the ground for a period of 2 min. The test was performed at ambient only.

There was no effect on either the metal or wood pallet, or the projectiles as a result of the hoisting test.

Sudden Lift Test

The pallet was suspended by two diagonally opposite projectile lifting plugs and then allowed to free fall 4 in. and brought to an abrupt stop. This test was performed at ambient only.

The metal pallet sustained minor bulging of the pallet cover around the hole for the one lifting plug to which the support chain was hooked. There was no effect on the function of the pallet. There was no evidence of damage to the projectiles (fig. 25).

Because of the problems encountered with the covers for the wood pallet, and the fact that it is a test of the cover, the sudden lift test was not performed on the wood pallet. However, this test has been conducted in other projectile pallet qualification tests and successfully passed.

Forklift Impact Test

The loaded pallet was placed lengthwise against a cinderblock wall. A forklift was then run into the pallet twice at a normal approach speed (approximately 1 mi/hr). The test was performed twice, once with the forklift tines tilted fully back and once with the tines horizontal. Each time the ends of the tines were approximately 15 in. above the ground in order to impact the projectiles in their most vulnerable section. The purpose of this test was to simulate mishaps which may occur during the lifting and/or stacking of a loaded pallet. This test was performed only at ambient and only with the metal pallet.

The first impact by the forklift (tines fully rearward) on the pallet resulted in two small dings, one in each of two projectiles; one on projectile 1151 and one on projectile 1108. During the second impact, the forklift tines struck the pallet at a slight angle. As a result, most of the force was transmitted through one forklift tine. The same two projectiles were again dented. The projectile which was subjected to the greater impact, 1108, sustained the deepest dent. This dent was measured as approximately 0.008 in. deep. This projectile was then sent to the Nuclear Systems and Stockpile Reliability Division for inspection. The projectile diameter was measured at several points along the projectile body. The projectile was also gauged. The results showed projectile diameter remained within tolerance, and the projectile successfully passed through the gauge. Based on these inspection results, the SADARM office, Precision Munitions Division determined that the projectiles had successfully passed the forklift impact test. As a precaution, the Precision Munitions Division recommended that both damaged projectiles be test fired upon completion of the packaging tests.

CONCLUSIONS

Metal Pallet

The sense and destroy armor (SADARM) projectiles remained consolidated in the metal pallet, and the pallet remained functional during the entire test sequence at each temperature. The only instance of projectile damage occurred during loose cargo testing at -65°F. The damage, a broken obturator band, is not considered a critical failure since it can be easily replaced. The failure was not deemed critical by the Precision Munitions Division of ARDEC, and it occurred during the most severe environmental test, and environment to which the pallet is not likely to be subjected. Therefore, the damage incurred was not sufficient to warrant a costly program involving modification to and retesting of the metal pallet for use with the projectile. In addition, the performance of the metal pallet was superior to that of the wood pallet. In light of this, the metal pallet was approved for use with and designated as the desired configuration for the SADARM projectile.

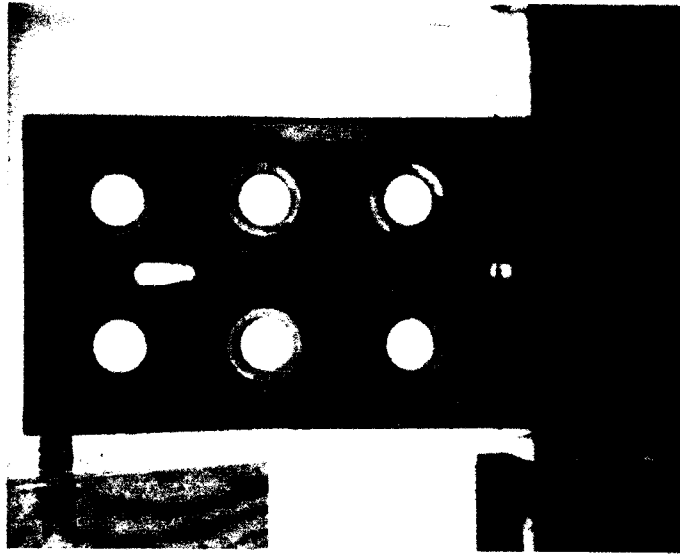
Wood Pallet

The first test sequence (ambient) proved that some modification, in addition to the modified grommet, was required for the wood pallet to be used with the SADARM projectile. In subsequent testing, this modification, the use of wood plugs, maintained its integrity and performed its function in preventing the grommet from contacting the pallet base.

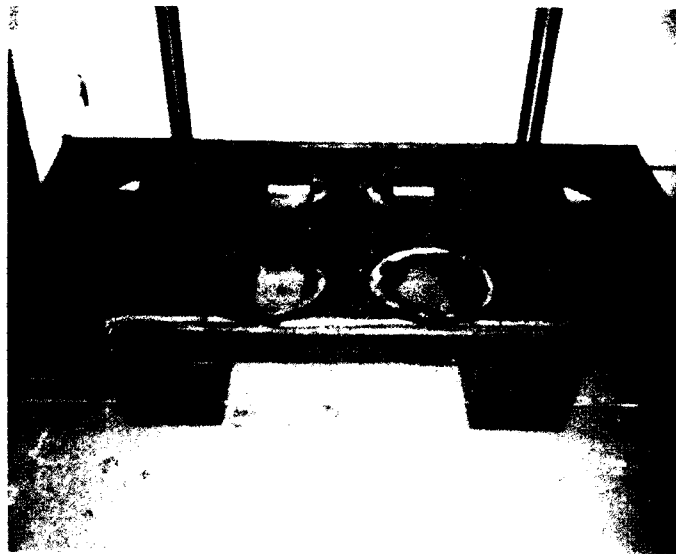
There were two instances (secured vibration at +160°F and second cornerwise drop at -65°F) where a projectile broke loose from the pallet, although the only damage sustained was a broken obturator band (secured vibration at ambient). However, none of this damage was attributed to the use of the wood plugs. Most of it can be attributed to improper manufacture of and/or inferior materials used for the pallet covers. In addition, since the wood pallet is already a qualified packaging configuration, the purpose of the testing was not to ensure performance of the pallet but only fit and function of the SADARM projectile within the wood pallet. Based on the test objectives, although the failure of the pallet covers may require further study, it does not affect the evaluation of the test results. The wood pallet is, therefore, approved as an alternate to the metal pallet as packaging for the XM898 SADARM projectile.

Modified Grommet

Further testing is required on the modified grommet before it can be approved for use on the XM898 projectile outside the pallet. However, the modified grommet functioned successfully during pallet testing and is, therefore, approved for use in the palletized configuration using both the metal and wood pallets.

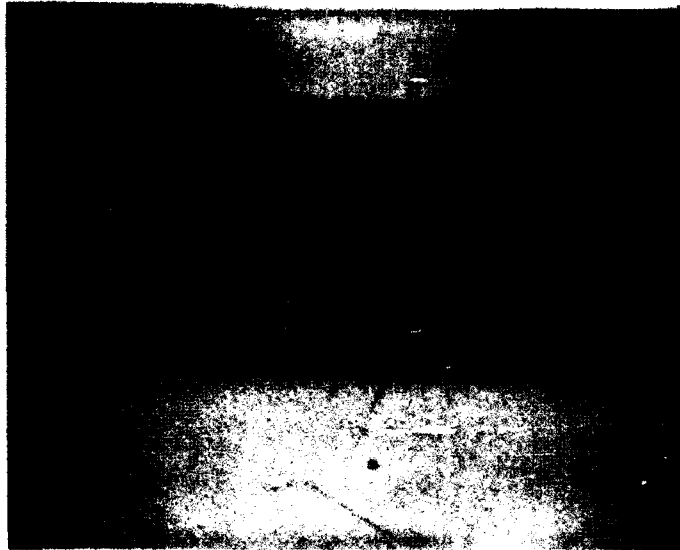


Cover



Base

Figure 1. Metal pallet after testing (ambient)



Cover



Base

Figure 2. Metal pallet base after testing (160°F)



Figure 3. Metal pallet base after testing (-65°F)

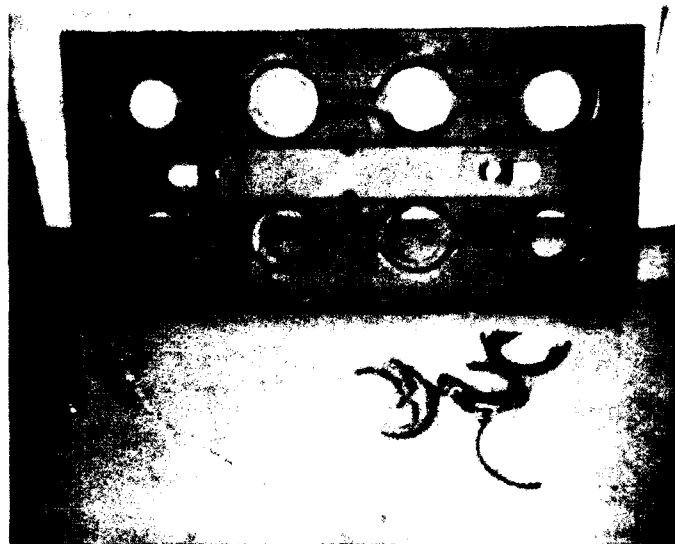


Figure 4. Metal pallet cover after testing (-65°F)

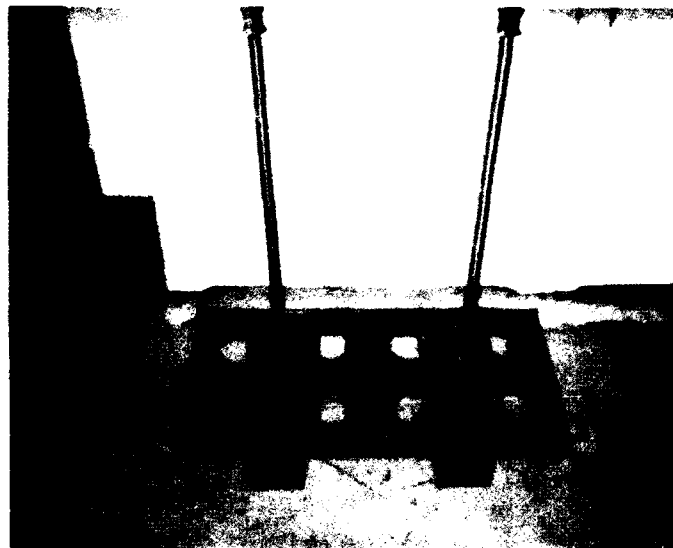
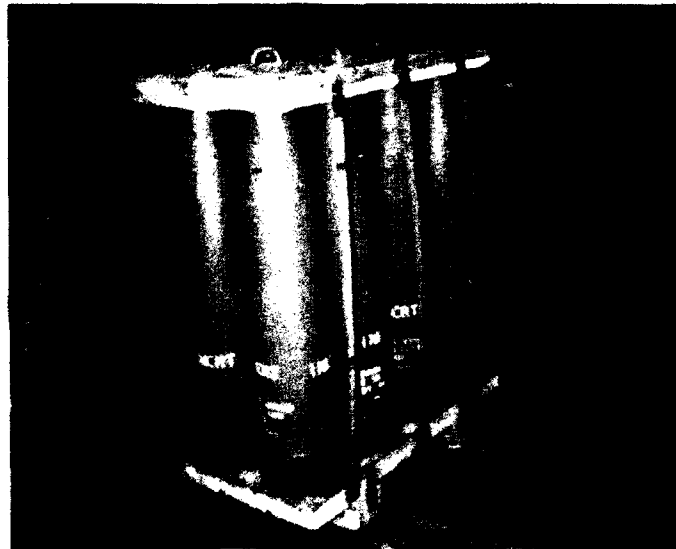
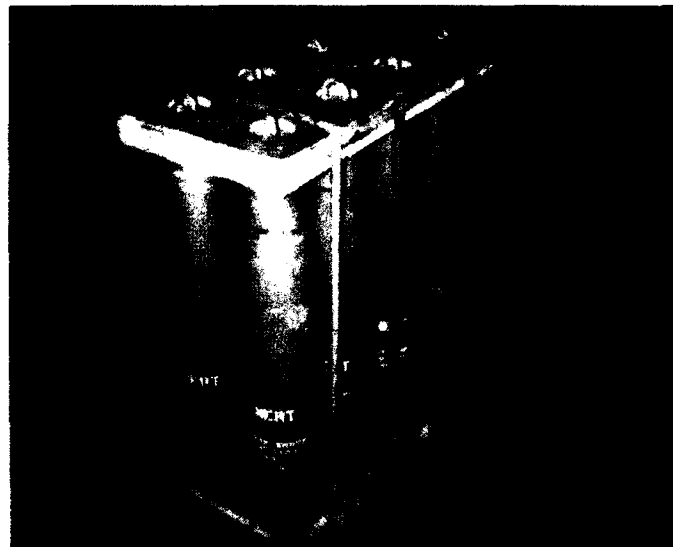


Figure 5. Metal pallet after testing (-65°F)



Ambient

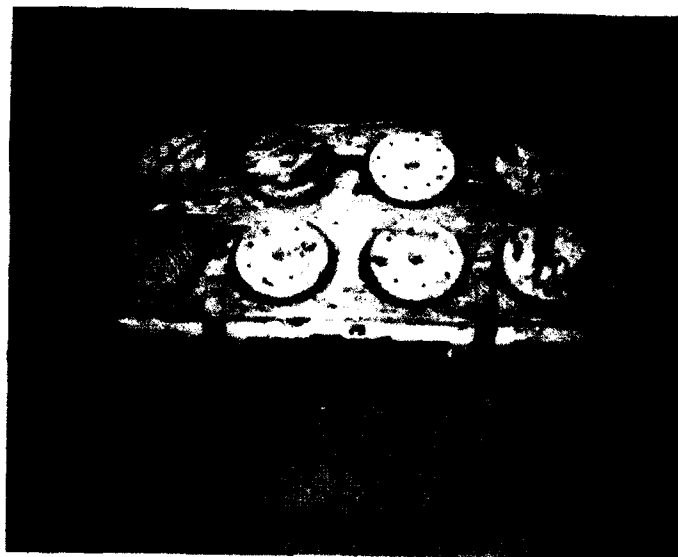


-65°F

Figure 6. Wood pallet after testing

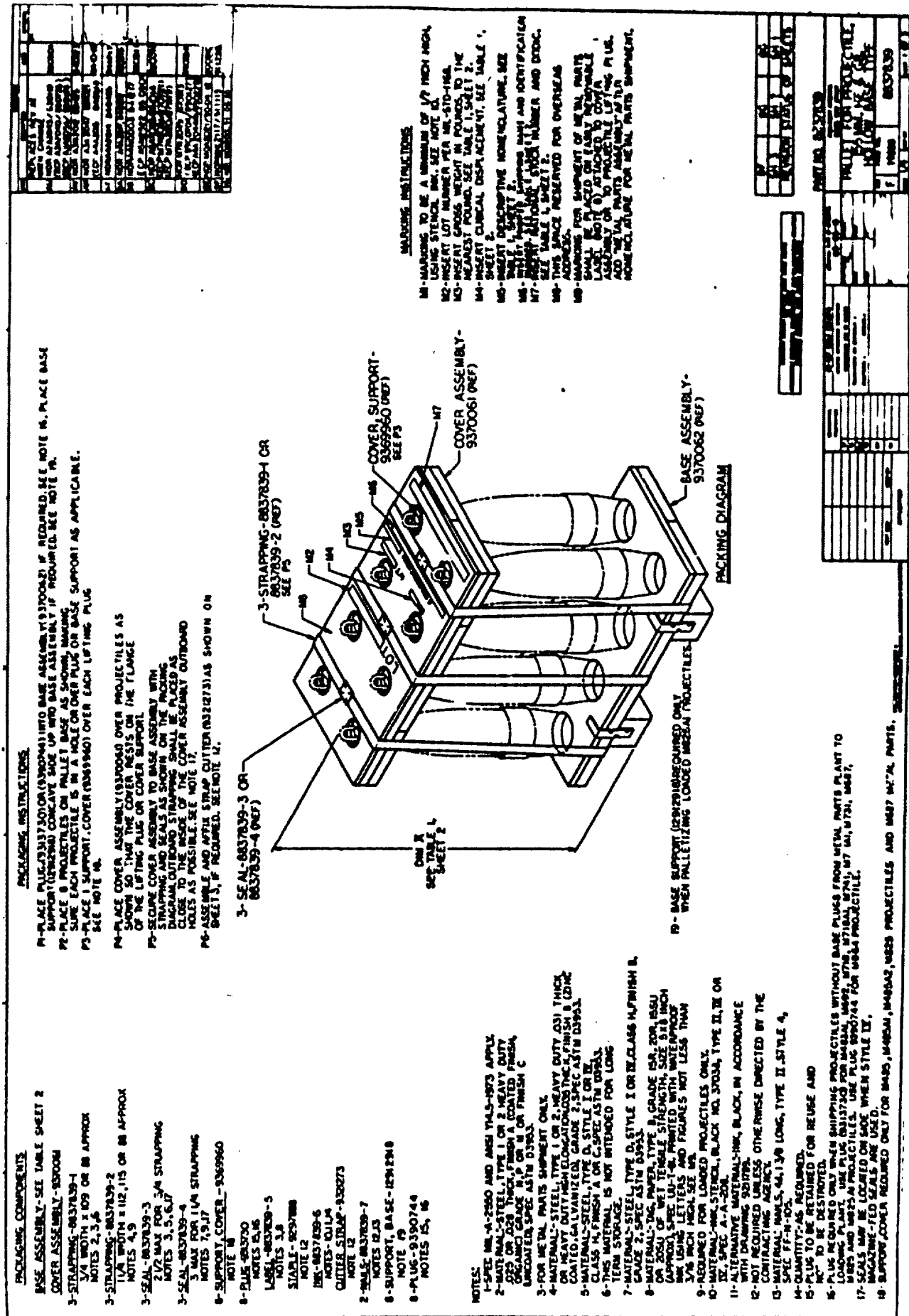


Ambient



-65°F

Figure 7. Wood pallet base after testing



1. APPLICABLE STANDARDS/SPECIFICATIONS:

- A. DOD-STD-00100D (AR)
B. MIL-A-2350
C. AMSI Y14.5M-1982
D. MIL-P-70951

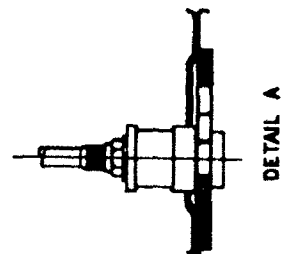
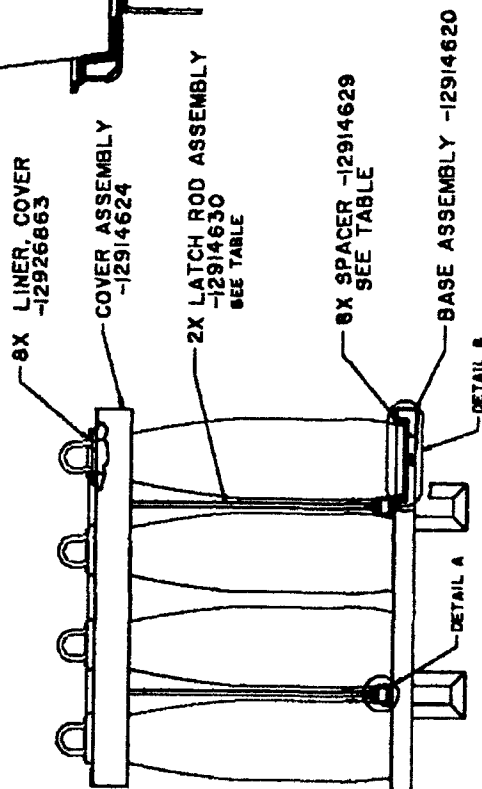
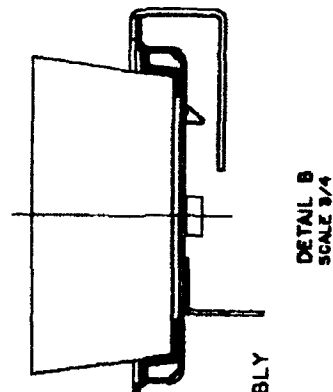
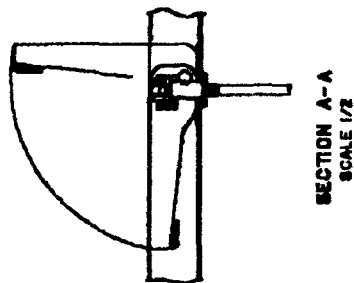


TABLE		
FAPP ASSEMBLY	SPACER	LATCH ROD ASSEMBLY
12914828-01	12914828-01	12914830-01
12914828-02	12914828-02	12914830-02
12914828-03	N/A	12914830-02

Figure 9. Field artillery projectile pallet (FAPP) assembly

- CONE VCLA TURN
-
- 2 REQUIMB

PACKING COMPONENT

- PALLET ASSEMBLY - 1293982 (NOTE 4)
- SUPPORT, COVER - 9349960 (NOTE 6), (TABLE 1)
- SUPPORT, BASE - 1291998 (NOTE 6), (TABLE 1)
- 12914919 - (NOTE 2, 3, 4)

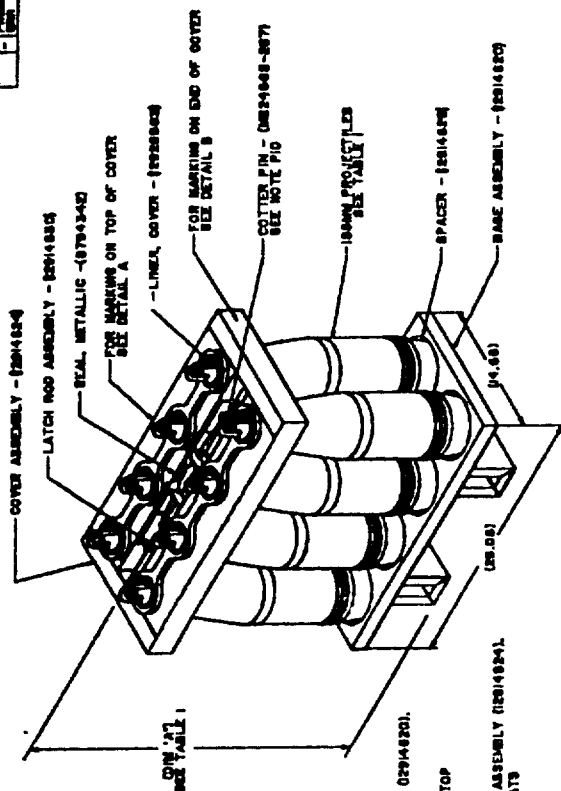
- 2 - COTTON PIN - MB24489-2217
- "EAL. METALLIC - 0794342

PACKING INSTRUCTIONS

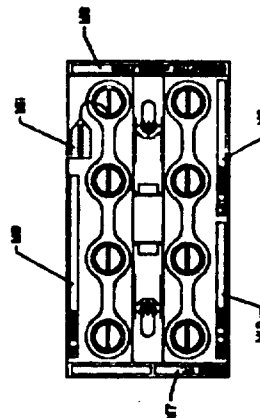
1. ATTACH LATCH ROD ASSEMBLY (22914830) TO BASE ASSEMBLY (22944400).
2. SNAP IN PIN (22944425) AS REQUIRED, ONE IN EACH CUP. IN THE BASE ASSEMBLY (22914830), (SEE TABLE 1).
3. PLACE SUPPORT, COVER (10359860) INTO BASE ASSEMBLY AS REQUIRED. (SEE TABLE 1).
4. PLACE PROJECTILE, ONE ON EACH SPACER (OR SUPPORT), IN A VERTICAL POSITION ATOP BASE ASSEMBLY.
5. PLACE SUPPORT, COVER (10359860) OVER EACH LIFTING PLUG.
6. S/LIDE. (SEE TABLE 1).
7. LINEAR COVER (22944433), ONE EACH CUP, IN THE UNDERSIDE OF THE COVER ASSEMBLY (22914830).
8. PLACE COVER ASSEMBLY OVER THE PROJECTILES INSURING THAT THE COVER SEATS TIGHTLY ON THE PROJECTILES.
9. LATCH ROD NUTS MUST BE PROPERLY TIGHTENED TO INSURE THAT THE LATCH ROD NUTS ARE PROPERLY SEATED IN THE LATCH HANDLE THROUGHS WHEN IN THE STORED POSITION.
10. LATCH ROD NUTS TO 8-12 FT-LBS.
11. ALL COTTER PIN (22944443-287) INTO LATCH NUT HOLES TO MAINTAIN ADJUSTMENT.
12. SEAL, METALLIC (87941542) TO CORRECT HANDLES AS SHOWN.

MARKING INSTRUCTIONS

1. PACKAGES TO BE STENCILLED OR STAMPED ON TOP SURFACE FOR BAR CODING 1932 MEL.
 2. LETTERS AND FIGURES SHALL BE MARKED WITH STENCIL INK, SEE NOTE 5.3.3.
 3. LETTERS AND FIGURES SHALL BE A MINIMUM OF 1/8 INCH HIGH AND THERE
 4. SHALL BE AT LEAST 1/8 INCH SPACING BETWEEN LETTERS.
 5. RELATIVE POSITIONS OF THE VARIOUS MARKING SHALL BE AS SHOWN.
 6. ALL BLOCKS ☐ SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.
 7. LOT NUMBER PER MIL-STD-883C, LOT NUMBER SHALL BE UNDERLINED.
 8. GROSS WEIGHT TO THE NEAREST POUND.
 9. DESCRIPTIVE NOMENCLATURE, SEE TABLE 1.
 10. UN MARKING, SEE TABLE 1.
 11. NATIONAL STOCK NUMBER AND DODIC, SEE TABLE 1.
 12. TAG RESERVED FOR OVERBREAD ADDRESS, SEE NOTE 5.
 13. TAGS FOR BULK AND CASE LOADS, REQUIREMENTS AND INFORMATION
 14. PROVIDED FOR THE USER TO BE PLACED ON THE END OF PALLET COVER
 15. PER TO DESCRIPTIVE NOMENCLATURE.
 16. GROSS WEIGHT IS NOT AVAILABLE, USE ESTIMATED GROSS WEIGHT.
 17. ESTIMATED WEIGHT OF PACKAGING OF COMPONENTS AND PROJECTILES, TABLE 1



PACKING DIAGRAM



DETAIL 1



DETAIL B
BAR COOING ON END OF COVER ADJACENT
TO DESCRIPTIVE NOMENCLATURE

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE
DISTRIBUTION IS UNLIMITED

ESTIMATED WEIGHT OF PACKAGING COMPONENTS		
P.I.	DESCRIPTION	WEIGHT (LBS)
1	PALETT BASE ASBY	34
2	PALETT COVER ASBY	29
3	LATCH ROD ASBY	3
4	TOTAL	66

[illegible]

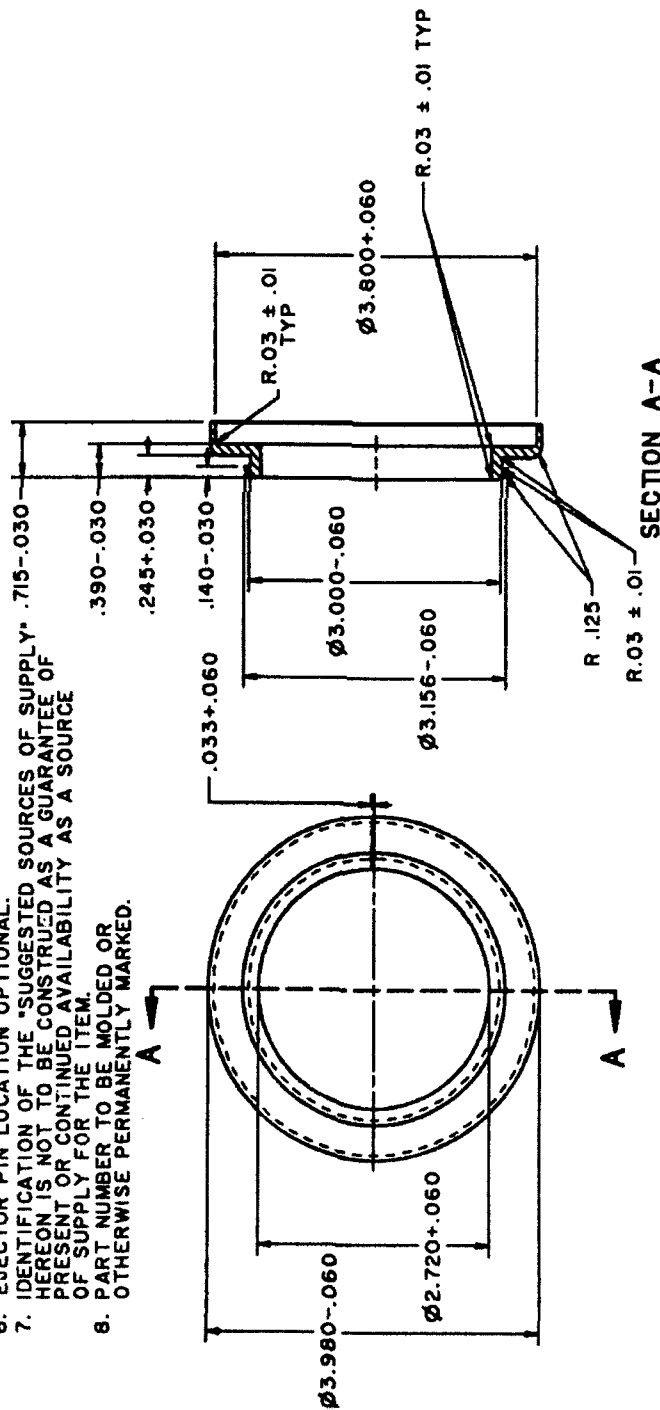
Figure 10. Packing and marking 155 mm projectile pallet

NOTES: --
1. APPLICABLE STANDARDS / SPECIFICATIONS:

- A. DOD-STD-00100D (AR)
- B. MIL-A-2550
- C. ANSI Y14.5M-1982
2. MATERIAL: PHILLIPS HIGH DENSITY POLYETHYLENE HMN 4550
3. PHYSICAL DATA:
DENSITY.....0.945 TO 0.950 G/CC
MELT FLOW.....1 TO 6 G/10MIN
TENSILE YIELD STRENGTH.....3400 PSI
COLOR OLIVE DRAB GREEN, COLOR NO. 34087 PER FED-STD-595.
5. MAX PERMISSIBLE FLASH HEIGHT .032.
6. EJECTOR PIN LOCATION OPTIONAL.
7. IDENTIFICATION OF THE "SUGGESTED SOURCE" HEREON IS NOT TO BE CONSTRUED AS A PRESENT OR CONTINUED AVAILABILITY AS A SOURCE OF SUPPLY FOR THE ITEM.
8. PART NUMBER TO BE MOLDED OR OTHERWISE PERMANENTLY MARKED.

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE/TIME AND DATE APPROVED
	-	PRODUCT BASELINE ERR MIK2122	9/11/18 FET

THIS DRAWING HAS BEEN ORIGINATED
ON A CAD SYSTEM LOCATED AT
ARMED, PROCTER ARSENAL, N.J.
CHANGES MUST BE INCORPORATED
U.S. ARMY CENTER



**DISTRIBUTION STATEMENT A.
APPROVED FOR PUBLIC RELEASE:
DISTRIBUTION IS UNLIMITED.**

SUGGESTED SOURCE OF SUPPLY (FOR MATERIAL)		
VENDOR	CAGE CODE	VENDOR PART NO.
PHILLIPS 66 COMPANY BARTLESVILLE OKLAHOMA 74004		HMM4550
CAIN CHEMICAL FIVE GREENWAY PLAZA SUITE 2500 PO BOX 27702 HOUSTON, TEXAS 77227-7702		ALATHON 5510

SPECIFICATION CONTROL DRAWING


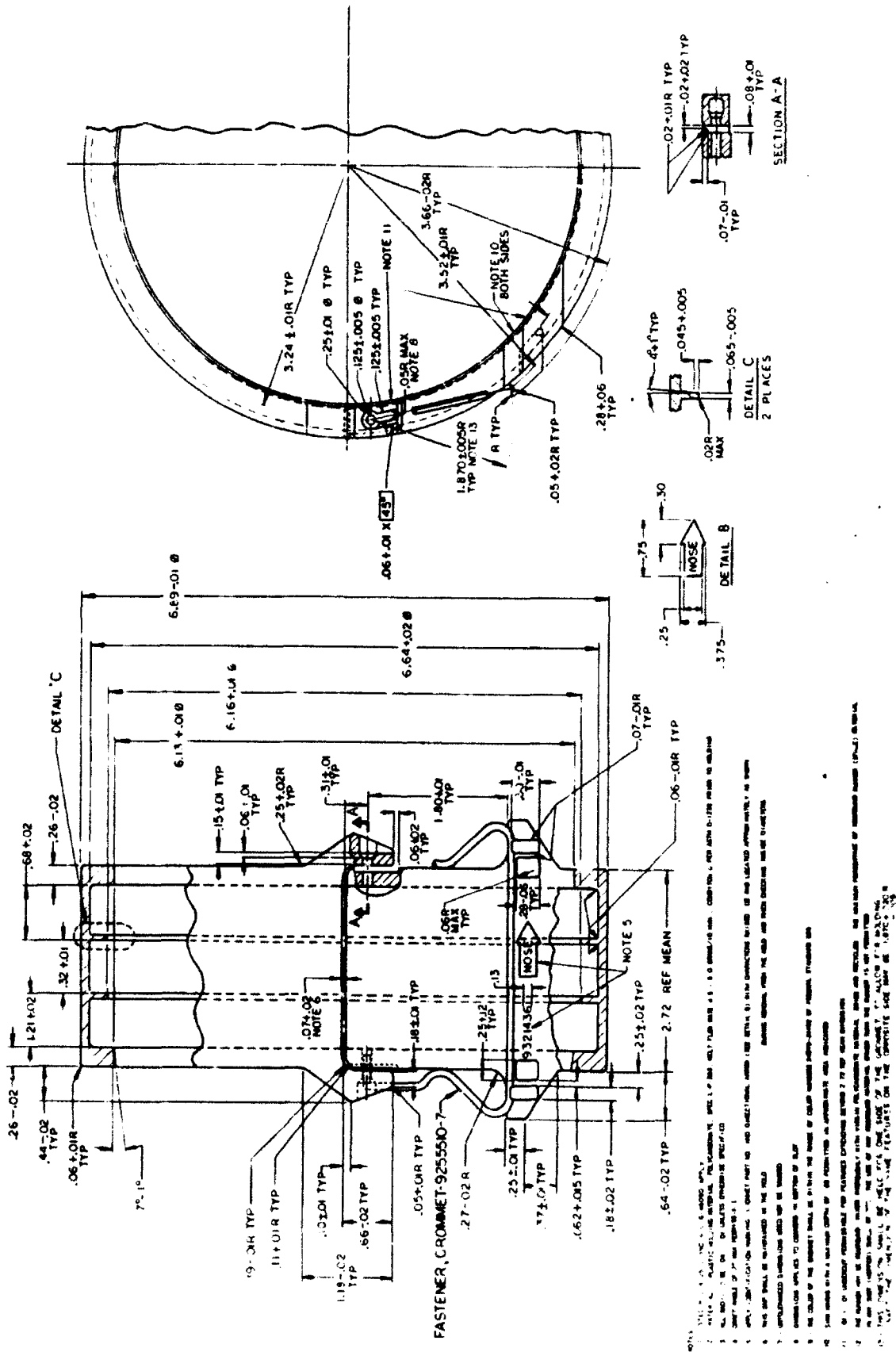
PMIC		DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMAL		CONTRACT NUMBER		DESIGN ACTIVITY U.S. ARMY ARMED FORCES, INDEPENDENT AND ENGINEERING CORPS PHARMACY MEDICAL, NEW ARMY 0700-0000	
MECHANICAL PROPERTIES		8 PL. *		DRAWN BY SJW		LINER, COVER	
3 PL. *		THIRD ANGLE PROJECTION		CHECKED		DATE 08-12-15	
TYP				DATE 08-12-15		SIZE CASE CODE	
T1				A.L.		C 19200	
T2				DATE 08-12-15		12926863	
T3				DATE 08-12-15			
T4				DATE 08-12-15			
T5		FAPP		DATE 08-12-15		DATE 08-12-15	
T6		NEXT ASSY		DATE 08-12-15		DATE 08-12-15	
T7		USED ON		DATE 08-12-15		DATE 08-12-15	
T8		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T9		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T10		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T11		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T12		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T13		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T14		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T15		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T16		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T17		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T18		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T19		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T20		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T21		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T22		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T23		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T24		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T25		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T26		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T27		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T28		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T29		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T30		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T31		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T32		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T33		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T34		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T35		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T36		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T37		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T38		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T39		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T40		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T41		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	
T42		DATE 08-12-15		DATE 08-12-15		DATE 08-12-15	

Figure 11. Liner, cover



PART NO 9321436

Figure 12. Grommet for M898 and M864 (155 mm) projectile



Figure 13. Modified grommet

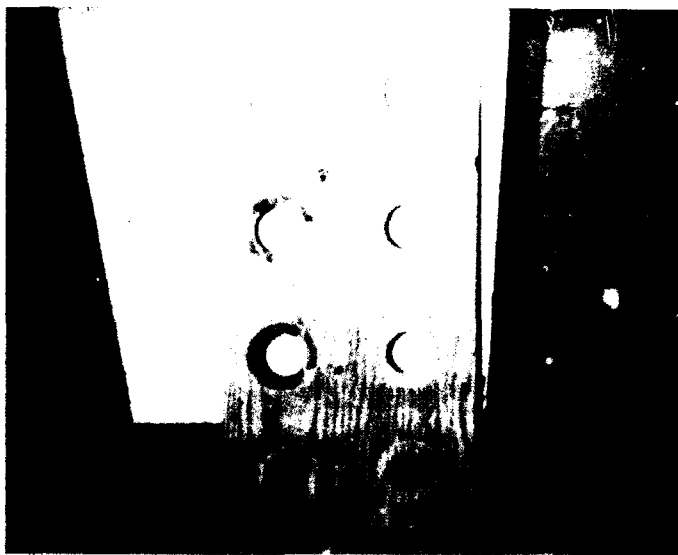


Figure 14. Wood pallet cover piece, improper manufacture

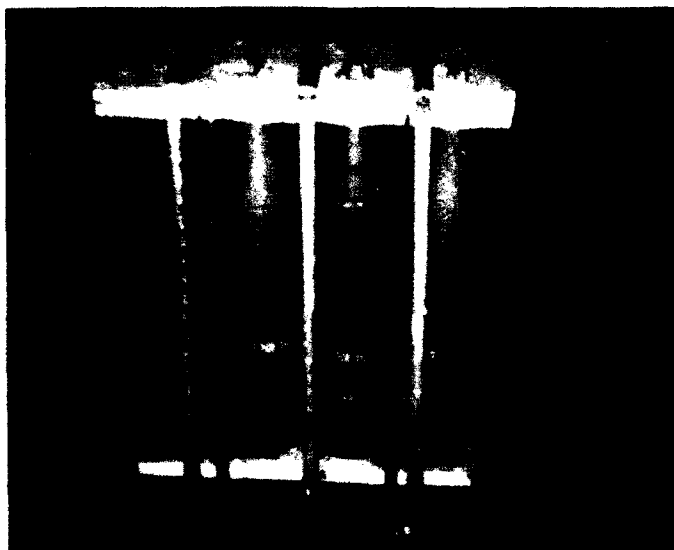


Figure 15. Wood pallet



Figure 16. Wood pallet base modified with disks



Figure 17. Wood pallet cover secured vibration test (+160°F)

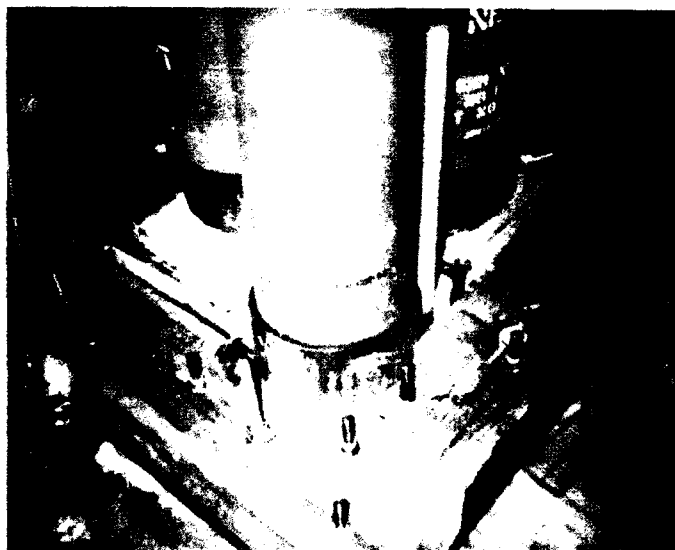
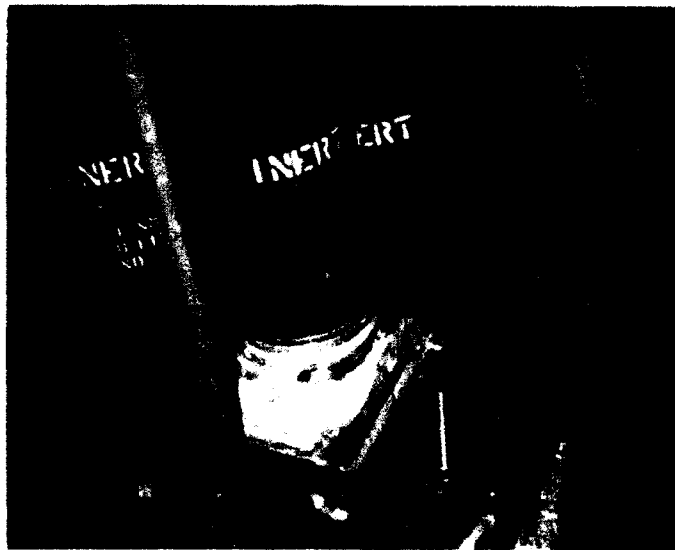
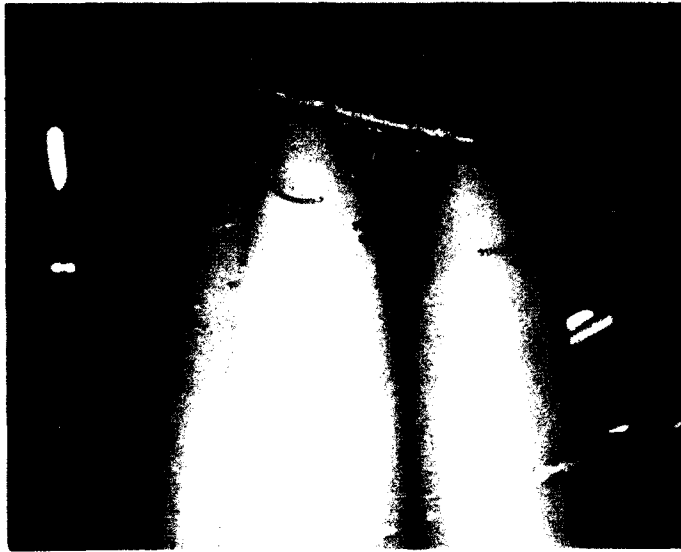


Figure 18. Wood pallet secured vibration test (+160°F)



Ambient



+160°F

Figure 19. Metal pallet after loose cargo test



Figure 20. Broken obturator band after pallet testing (-65°F)

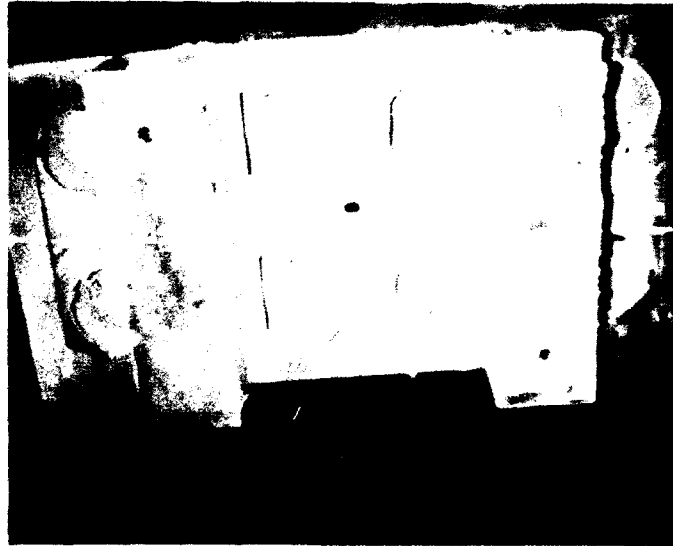


Figure 21. Metal pallet after loose cargo test (-65°F)



Figure 21. (cont)

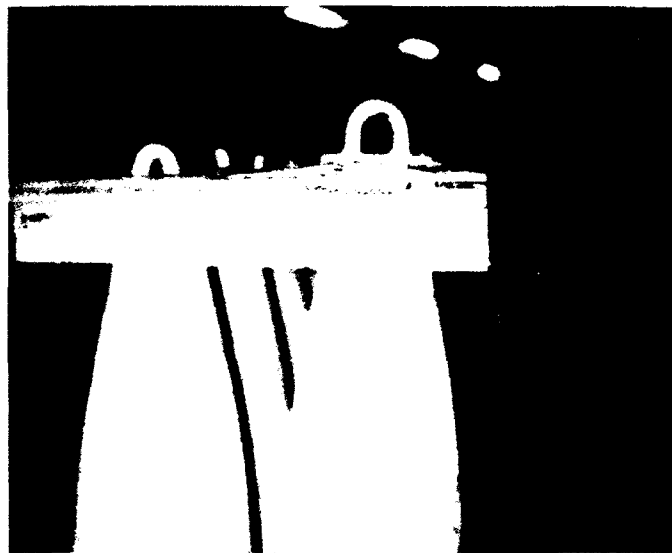


Figure 22. Wood pallet cover after 1st cornerwise drop (-65°F)

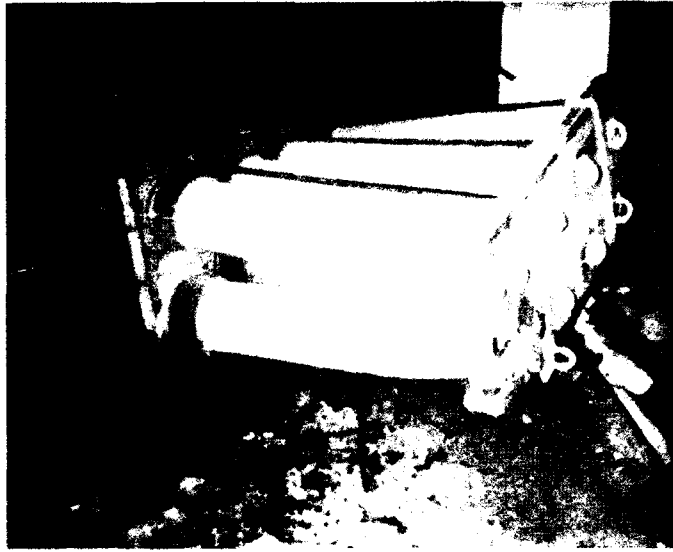


Figure 23. Wood pallet after 2nd cornerwise drop (-65°F)



Figure 24. Wood pallet cover after rollover (ambient)

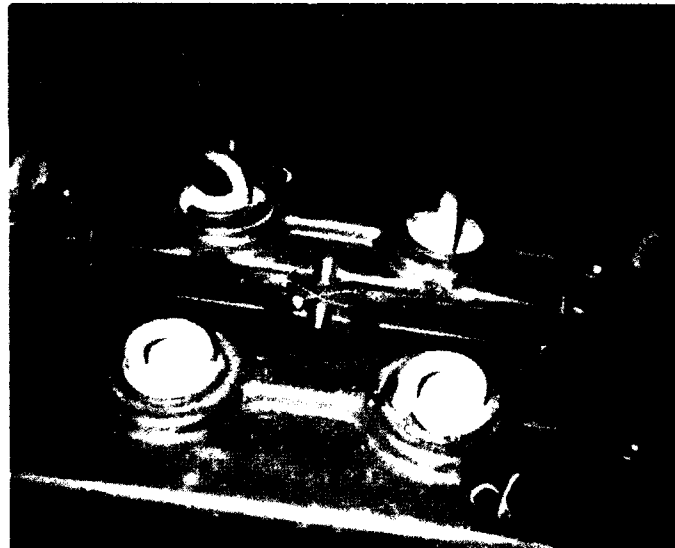


Figure 25. Metal pallet cover after sudden lift test

DISTRIBUTION LIST

Commander
Armament Research, Development and Engineering Center
U.S. Army Armament, Munitions and Chemical Command
ATTN: SMCAR-IMI-I (3)
SMCAR-AEP (10)
Picatinny Arsenal, NJ 07806-5000

Commander
U.S. Army Armament, Munitions and Chemical Command
ATTN: AMSMC-GCL (D)
Picatinny Arsenal, NJ 07806-5000

Administrator
Defense Technical Information Center
ATTN: Accessions Division (12)
Cameron Station
Alexandria, VA 22304-6145

Director
U.S. Army Material Systems Analysis Activity
ATTN: AMXSY-MP
Aberdeen Proving Ground, MD 21005-5066

Commander
Chemical/Biological Defense Agency
U.S. Army Armament, Munitions and Chemical Command
ATTN: AMSCB-CII, Library
Aberdeen Proving Ground, MD 21010-5423

Director
U.S. Army Edgewood Research, Development and Engineering Center
ATTN: SCBRD-RTT (Aerodynamics Technical Team)
Aberdeen Proving Ground, MD 21010-5423

Director
U.S. Army Research Laboratory
ATTN: AMSRL-OP-CI-B, Technical Library
Aberdeen Proving Ground, MD 21005-5066

Chief
Benet Weapons Laboratory, CCAC
Armament Research, Development and Engineering Center
U.S. Army Armament, Munitions and Chemical Command
ATTN: SMCAR-CCB-TL
Watervliet, NY 12189-5000

Commander
U.S. Army Rock Island Arsenal
ATTN: SMCRI-IMC-RT, Technical Library
Rock Island, IL 61299-6000

Director
U.S. Army TRADOC Analysis Command-WSMR
ATTN: ATRC-WSS-R
White Sands Missile Range, NM 88002